[7590-01-P]

NUCLEAR REGULATORY COMMISSION

[Docket No. 50-335; NRC-2014-0076]

Exemption for Florida Power & Light Company

St. Lucie Plant, Unit 1

AGENCY: Nuclear Regulatory Commission.

ACTION: Exemption; issuance.

SUMMARY: The U.S. Nuclear Regulatory Commission (NRC) is granting an exemption in response to a May 10, 2013, request from Florida Power & Light Company for an exemption for the use of a different fuel rod cladding material (AREVA M5®).

ADDRESSES: Please refer to Docket ID **NRC-2014-0076** when contacting the NRC about the availability of information regarding this document. You may access publicly-available information related to this action by the following methods:

- **Federal Rulemaking Web site:** Go to http://www.regulations.gov and search for Docket ID **NRC-2014-0076**. Address questions about NRC dockets to Carol Gallagher; telephone: 301-287-3422; e-mail: Carol.Gallagher@nrc.gov. For technical questions, contact the individual listed in the FOR FURTHER INFORMATION CONTACT section of this document.
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- **NRC's PDR:** You may examine and purchase copies of public documents at the NRC's PDR, Room O1-F21, One White Flint North, 11555 Rockville Pike, Rockville, Maryland 20852.

FOR FURTHER INFORMATION CONTACT: Lisa M. Regner, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission, Washington DC 20555-0001; telephone: 301-415-1906; e-mail: Lisa.Regner@nrc.gov.

I. Background.

Florida Power & Light Company (the licensee) is the holder of Renewed Facility Operating License No. DPR-67, which authorizes operation of the St. Lucie Plant, Unit 1. The license provides, among other things, that the facility is subject to all rules, regulations, and orders of the NRC now or hereafter in effect. The facility consists of a pressurized-water reactor (PWR) located in St. Lucie County, Florida.

II. Request/Action.

In accordance with § 50.12, of Title 10 of the *Code of Federal Regulations* (10 CFR), "Specific exemptions," the licensee, by letter dated May 10, 2013 (ADAMS Accession No. ML13135A008), requested an exemption from the requirements of 10 CFR 50.46, "Acceptance criteria for emergency core cooling systems [ECCS] for light-water nuclear power reactors," and 10 CFR Part 50, Appendix K, "ECCS Evaluation Models," to allow the use of fuel rods clad with AREVA M5® alloy for future reload applications. The regulations in 10 CFR 50.46 contain acceptance criteria for the ECCS for reactors fueled with zircaloy or ZIRLO™ fuel rod cladding material. In addition, Appendix K to 10 CFR Part 50 requires that the Baker-Just equation be used to predict the rates of energy release, hydrogen concentration, and cladding oxidation from the metal/water reaction. The Baker-Just equation assumes the use of a zirconium alloy, which is a material different from the AREVA M5® material. The licensee requested the exemption because these regulations do not have criteria for the use of fuel rods clad in a material other than zircaloy or ZIRLO™. Because the material specifications of M5® differ from the specification for zircaloy or ZIRLO™, a plant-specific exemption is required to support the reload applications for St. Lucie Plant Unit 1.

The exemption request relates solely to the cladding material specified in these regulations (i.e., fuel rods with zircaloy or ZIRLO™ cladding material). This exemption would provide for the application of the acceptance criteria of 10 CFR 50.46 and Appendix K to 10 CFR Part 50 to fuel assembly designs using AREVA M5® fuel rod cladding material.

III. Discussion.

Pursuant to 10 CFR 50.12, the Commission may, upon application by any interested person, grant exemptions from the requirements of 10 CFR Part 50, which are authorized by law, will not present an undue risk to the public health and safety, and are consistent with the common defense and security. Paragraph (a)(2)(ii) of 10 CFR 50.12 states that the Commission will not consider granting an exemption unless special circumstances are present, such as when application of the regulation in the particular circumstance is not necessary to achieve the underlying purpose of the rule.

A. Special Circumstances.

Special circumstances, in accordance with 10 CFR 50.12(a)(2)(ii), are present whenever application of the regulation in the particular circumstances is not necessary to achieve the underlying purpose of the rule. The underlying purpose of 10 CFR 50.46 and Appendix K to 10 CFR Part 50 is to establish acceptance criteria for ECCS performance. The regulations in 10 CFR 50.46 and Appendix K are not expressly applicable to M5® cladding material, because the M5® cladding material is not specified in 10 CFR 50.46 or presumed in the Baker-Just equation required by paragraph I.A.5 of 10 CFR Part 50, Appendix K. The evaluations described in the following sections of this exemption, however, show that the intent of the regulation is met, in that, subject to certain conditions, the acceptance criteria are valid for M5® zircaloy-based alloy cladding, the material is less susceptible to embrittlement, and the Baker-Just equation conservatively bounds scenarios following a loss of coolant accident (LOCA) for rods with M5® cladding material. Thus, a strict application of the rule (which would preclude the

applicability of ECCS performance acceptance criteria to, and the use of, M5® clad fuel rods) is not necessary to achieve the underlying purposes of 10 CFR 50.46 and Appendix K of 10 CFR Part 50. The purpose of these regulations is achieved through the application of the requirements to the use of M5® fuel rod cladding material. Therefore, the special circumstances required by 10 CFR 50.12(a)(2)(ii) for the granting of an exemption exist.

B. The Exemption is Authorized by Law.

This exemption would allow the use of M5® fuel rod cladding material for future reload applications at St. Lucie Plant, Unit 1. Section 10 CFR 50.12 allows the NRC to grant exemptions from the requirements of 10 CFR Part 50 provided that special circumstances are present. The NRC staff determined that special circumstances exist to grant the proposed exemption and that granting the exemption would not result in a violation of the Atomic Energy Act of 1954, as amended, or the Commission's regulations. Therefore, the exemption is authorized by law.

C. The Exemption Presents No Undue Risk to Public Health and Safety.

Section 10 CFR 50.46 requires that each boiling or pressurized light-water nuclear power reactor fueled with uranium oxide pellets within cylindrical zircaloy or ZIRLO cladding must be provided with an ECCS that must be designed so that its calculated cooling performance following postulated LOCAs conforms to the criteria set forth in paragraph (b) of this section. The underlying purpose of 10 CFR 50.46 is to establish acceptance criteria for ECCS performance at nuclear power reactors. The NRC staff previously documented its approval of AREVA topical report BAW-10227P, "Evaluation of Advanced Cladding and Structural Material (M5®) in PWR Reactor Fuel," in a safety evaluation dated February 4, 2000

(ADAMS Accession No. ML003681490), and concluded that the 10 CFR 50.46 and 10 CFR Part 50, Appendix K, criteria are applicable to M5® fuel, subject to compliance with specific conditions. The specific conditions that address the use of M5® with respect to ECCS performance requirements are: (1) the corrosion limit will remain below 100 microns for all locations of the fuel; (2) all conditions listed in the NRC safety evaluations for AREVA methodologies for M5® fuel analysis will continue to be met; (3) AREVA methodologies will be used only within the range for which M5® data was acceptable and for which the verifications discussed in the topical reports were performed; and (4) the burnup limit for implementation of M5® is 62 gigawatt-days per megaton uranium metal (GWd/MTU). The staff determined that the licensee has satisfied these conditions. The corrosion limit stated in condition (1) is verified by the licensee for each reload as required by TS 6.9.1.11, "Core Operating Limits Report [COLR]." The conditions from NRC approved safety evaluations stated in condition (2) are incorporated as restrictions in AREVA procedures that control the core reload designs which are also verified by the licensee for each reload as required by the COLR. The restrictions on the use of AREVA methodologies stated as condition (3) are also incorporated as restrictions in AREVA procedures that control the core reload designs which are also verified for each reload as required by the COLR. Finally, the burnup limit stated in condition (4) is currently part of the St. Lucie Plant, Unit 1, COLR, and is also verified as part of the reload analysis required by the COLR.

The AREVA topical report BAW-10227P-A, which was submitted to the NRC by letter dated February 11, 2000 (ADAMS Accession No. ML003685828), demonstrates that M5® has essentially the same properties as the current zircaloy cladding material and requires no change in fuel rod dimensions. Subsequently, the NRC staff approved topical report, BAW-10240P-A, "Incorporation of M5 Properties in Framatome ANP Approved Methods" (dated May 5, 2004; ADAMS Accession No. ML041260560), which further addressed M5® material properties with

respect to LOCA applications and reached similar conclusions.

Based on the recently completed LOCA research program at Argonne National Laboratory (ANL), the results showed that cladding corrosion and associated hydrogen pickup had a significant impact on postquench ductility. The research identified a new embrittlement mechanism referred to as hydrogen-enhanced beta layer embrittlement. Pretest characterization of irradiated M5® fuel cladding segments at ANL provides further evidence of favorable corrosion and hydrogen pickup characteristics of M5® as compared with standard zircaloy. Due to its favorable hydrogen pickup, fuel rods with M5® zirconium-based alloy cladding are less susceptible to this new embrittlement mechanism.

Furthermore, ANL postquench ductility tests on un-irradiated and irradiated M5® cladding segments demonstrate that the 10 CFR 50.46(b) acceptance criteria (i.e., 2200 degrees Fahrenheit and 17-percent equivalent cladding reacted) remain conservative up to the current burnup limit of 62 GWd/MTU. Information provided in the previously approved M5® topical reports and recent ANL LOCA research demonstrate that the acceptance criteria within 10 CFR 50.46 remain valid for the M5® alloy material, and thus the underlying purpose of the rule – to maintain a degree of post-quench ductility in the fuel cladding material through ECCS performance criteria – would be served if an exemption were granted to allow those criteria to apply to M5® clad fuel.

In addition, utilizing currently-approved LOCA models and methods and consistent with technical specifications, the licensee will perform an evaluation to ensure that the M5® fuel rods continue to satisfy 10 CFR 50.46 acceptance criteria. Therefore, for the reasons above, granting the exemption request will ensure that the underlying purpose of the rule is achieved for St. Lucie Plant, Unit 1. Thus, a strict application of the rule (which would prohibit the applicability of ECCS performance acceptance criteria to M5® clad fuel rods) is not necessary to achieve the underlying purpose of the rule.

Paragraph I.A.5 of Appendix K to 10 CFR Part 50 states that the rates of energy, hydrogen concentration, and cladding oxidation from the metal-water reaction shall be calculated using the Baker-Just equation. Since the Baker-Just equation presumes the use of zircaloy clad fuel, strict application of the rule would not permit use of the equation for the advanced zirconium-based M5® alloy for determining acceptable fuel performance. The underlying intent of this portion of the appendix, however, is to ensure that the analysis of fuel response to LOCAs is conservatively calculated. The approved AREVA topical reports show that due to the similarities in the chemical composition of the advanced zirconium-based M5® alloy and zircaloy, the application of the Baker-Just equation in the analysis of the M5® clad fuel rods will continue to conservatively bound all post-LOCA scenarios. For the reasons above, granting the exemption request will ensure that the Baker-Just equation can be applied to M5® clad fuel and that the underlying purpose of the rule is achieved for St. Lucie Plant, Unit 1. Thus, a strict application of the rule (which would preclude the application of the Baker-Just equation) is not necessary to achieve the underlying purpose of the rule.

Based upon results of metal-water reaction testing and mechanical testing which ensure the applicability of 10 CFR 50.46 acceptance criteria and 10 CFR 50 Appendix K methods, the staff finds it acceptable to grant an exemption from the requirements of 10 CFR 50.46 and Appendix K to 10 CFR Part 50 to allow these regulations to apply to, and enable the use of, fuel rods with M5® zirconium-based alloy at St. Lucie Plant, Unit 1. Therefore, the exemption presents no undue risk to public health and safety.

D. <u>The Exemption is Consistent with the Common Defense and Security</u>.

The licensee's exemption request is only to allow the application of the aforementioned

regulations to an improved fuel rod cladding material that is not specified or presumed by the cited regulations. In its letter dated May 10, 2013, the licensee stated that 10 CFR 50.46 and 10 CFR Part 50, Appendix K, requirements and acceptance criteria will be maintained. The licensee is required to handle and control special nuclear material in these assemblies in accordance with its approved plant procedures. This change to the reactor core internals is adequately controlled by NRC requirements and is not related to security issues. Therefore, the NRC staff determined that this exemption does not impact common defense and security and thus, is consistent with the common defense and security.

E. Environmental Considerations.

The NRC staff determined that the exemption discussed herein meets the eligibility criteria for the categorical exclusion set forth in 10 CFR 51.22(c)(9) because it is related to a requirement concerning the installation or use of a facility component located within the restricted area, as defined in 10 CFR Part 20, and the granting of this exemption involves: (i) no significant hazards consideration, (ii) no significant change in the types or a significant increase in the amounts of any effluents that may be released offsite, and (iii) no significant increase in individual or cumulative occupational radiation exposure. Therefore, in accordance with 10 CFR 51.22(b), no environmental impact statement or environmental assessment need to be prepared in connection with the NRC's consideration of this exemption request. The basis for the NRC staff's determination is discussed in the following evaluation of the requirements in 10 CFR 51.22(c)(9)(i) – (iii).

Requirements in 10 CFR 51.22(c)(9)(i)

The NRC staff evaluated the issue of no significant hazards consideration, using the

standards described in 10 CFR 50.92(c), as presented as follows:

1. Does the proposed exemption involve a significant increase in the probability or consequences of an accident previously evaluated?

No. The proposed exemption would allow the use of M5® fuel rod cladding material in the St. Lucie Plant Unit 1 reactor core. The NRC-approved topical reports, BAW-10227P-A and BAW-10240(P)(A), address the M5® material and demonstrate that it has essentially the same properties as currently licensed zircaloy. The fuel cladding itself is not an accident initiator and does not affect accident probability. Use of M5® fuel rod cladding material will continue to meet all 10 CFR 50.46 acceptance criteria and, therefore, will not increase the consequences of an accident. Therefore, the proposed exemption does not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. Does the proposed exemption create the possibility of a new or different kind of accident from any accident previously evaluated?

No. The use of M5® fuel rod cladding material will not result in changes in the operation or configuration of the facility. The NRC-approved topical reports BAW-10227P-A and BAW-10240(P)(A) demonstrated that the material properties of M5® are similar to those of zircaloy. The M5® fuel rod cladding material will perform similarly to those fabricated from zircaloy, thus precluding the possibility of the fuel cladding becoming an accident initiator and causing a new or different type of accident. Therefore, the proposed exemption does not create the possibility of a new or different kind of accident from any previously evaluated.

3. Does the proposed exemption involve a significant reduction in a margin of safety?

No. The proposed exemption does not involve a significant reduction in a margin of safety because it has been demonstrated that the material properties of the M5® material are not significantly different from those of zircaloy. M5® is expected to perform similarly to zircaloy for all normal operating and accident scenarios, including both LOCA and non-LOCA scenarios.

For LOCA scenarios, plant-specific LOCA analyses using M5® properties demonstrate that the acceptance criteria of 10 CFR 50.46 have been satisfied. Therefore, the proposed exemption does not involve a significant reduction in a margin of safety.

Based on the above, the NRC staff concludes that the proposed exemption presents no significant hazards consideration under the standards set forth in 10 CFR 50.92(c), and, accordingly, a finding of no significant hazards consideration is justified.

Requirements in 10 CFR 51.22(c)(9)(ii)

The proposed exemption would allow the use of M5® fuel rod cladding material in the reactors. AREVA M5® material has essentially the same properties as the currently licensed zircaloy cladding. The use of the M5® fuel rod cladding material will not significantly change the types of effluents that may be released offsite, or significantly increase the amount of effluents that may be released offsite. Therefore, the provisions of 10 CFR 51.22(c)(9)(ii) are met.

Requirements in 10 CFR 51.22(c)(9)(iii)

The proposed exemption would allow the use of the M5® fuel rod cladding material in the St. Lucie Plant, Unit 1 reactor core. M5® has essentially the same properties as the currently used zircaloy cladding. The use of the M5® fuel rod cladding material will not significantly increase individual occupational radiation exposure, or significantly increase cumulative occupational radiation exposure. Therefore, the provisions of 10 CFR 51.22(c)(9)(iii) are met.

IV. Conclusions.

Accordingly, the Commission has determined that, pursuant to 10 CFR 50.12(a)(1), the exemption is authorized by law, will not present an undue risk to the public health and safety,

and is consistent with the common defense and security. Also, special circumstances required by 10 CFR 50.12(a)(2)(ii) are present. Therefore, the Commission hereby grants the licensee an exemption from the requirements of 10 CFR 50.46 and Appendix K to 10 CFR Part 50, to allow the application of those criteria to, and the use of, M5® fuel rod cladding material at St. Lucie Plant Unit 1.

This exemption is effective upon issuance.

Dated at Rockville, Maryland, this 31st day of March 2014.

FOR THE NUCLEAR REGULATORY COMMISSION

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